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① a) 5^6 b) Base, Exponent

② a) sum

$3^4 \cdot 3^5 = 3^{4+5}$

$= 3^9$

b) subtract

$\frac{3^5}{3^2} = 3^{5-2}$

$= 3^3$

③ a) $\sqrt[3]{5} = 5^{\frac{1}{3}}$ b) $5^{\frac{1}{2}} = \sqrt[2]{5^1}$

$= \sqrt{5}$

c) No, $\sqrt{5^2} = (5^2)^{\frac{1}{2}}$ $(\sqrt{5})^2 = (5^{\frac{1}{2}})^2$

$= 5^{2 \cdot \frac{1}{2}}$ $= 5^{\frac{1}{2} \cdot 2}$

$= 5^{\frac{2}{2}}$ $= 5^{\frac{2}{2}}$

$= 5$ $= 5$

④ $4^{\frac{3}{2}}$ means $(\sqrt{4})^3$

$4^{\frac{3}{2}}$ mean $\sqrt{4^3}$

Either Take Square root of 4 and cube that result. or Cube 4 and then take square root of that result.

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(5) Multiply the numerator and denominator by the needed radical.

$$\frac{1}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{3}}{3}$$

(6) $5^{\frac{1}{3}} \cdot 5^{\frac{2}{3}} = 5^{\frac{3}{3}}$

$= 5^1$

$= 5$

(7) $\frac{1}{\sqrt{5}} = 5^{-\frac{1}{2}}$

(8) $\sqrt[3]{7^2} = 7^{\frac{2}{3}}$

(9) $\sqrt[3]{4^2} = 4^{\frac{2}{3}}$

(10) $\frac{1}{\sqrt{11^3}} = 11^{-\frac{3}{2}}$

(11) $\sqrt[5]{5^3} = 5^{\frac{3}{5}}$

(12) $\frac{1}{\sqrt[2]{2^3}} = 2^{-1.5}$

$= 2^{-\frac{3}{2}}$

$= \frac{1}{2^{\frac{3}{2}}}$

(13) $\sqrt[5]{a^2} = a^{\frac{2}{5}}$

(14) $\frac{1}{\sqrt{x^5}} = x^{-\frac{5}{2}}$

(15) $-3^2 = -9$

a)

b) $(-3)^2 = 9$

c) $\left(\frac{1}{3}\right)^4 (-3)^2$

$= \frac{1}{9}$

$x=3,\ y=4,\ z=-1$

(27) $(9x)^{\frac{2}{3}} + (2y)^{\frac{2}{3}} + z^{\frac{2}{3}}$

$= (9 \cdot 3)^{\frac{2}{3}} + (2 \cdot 4)^{\frac{2}{3}} + (-1)^{\frac{2}{3}}$

$= (3)^2 + (2)^2 + (-1)^2$

$= 9 + 4 + 1$

$= \boxed{14}$

(28) $(xy)^{2z}$

$= (3 \cdot 4)^{(2(-1))}$

$= (12)^{-2}$

$= \frac{1}{(12)^2}$

$= \boxed{\frac{1}{144}}$

(29) $\sqrt{32} + \sqrt{18}$

$= \sqrt{16 \cdot 2} + \sqrt{9 \cdot 2}$

$= \boxed{4\sqrt{2} + 3\sqrt{2}}$

$= 7\sqrt{2}$

(30) $\sqrt{75} + \sqrt{48}$

$= \sqrt{25 \cdot 3} + \sqrt{16 \cdot 3}$

$= 5\sqrt{3} + 4\sqrt{3}$

$= \boxed{9\sqrt{3}}$

(31) $\sqrt[5]{96} + \sqrt[5]{3}$

$= \sqrt[5]{32 \cdot 3} + \sqrt[5]{3}$

$= 2\sqrt[5]{3} + \sqrt[5]{3}$

$= \boxed{3\sqrt[5]{3}}$

(32) $\sqrt[4]{48} - \sqrt[4]{3}$

$= \sqrt[4]{16 \cdot 3} - \sqrt[4]{3}$

$= 2\sqrt[4]{3} - \sqrt[4]{3}$

$= \boxed{\sqrt[4]{3}}$

(33) $\sqrt{16x} + \sqrt{x^5}$

$= 4\sqrt{x} + x^2\sqrt{x}$

$= (4 + x^2)\sqrt{x}$

$= \boxed{(x^2+4)\sqrt{x}}$

(34) $\sqrt[3]{2y^4} - \sqrt[3]{y}$

$= \boxed{y\sqrt[3]{2y} - \sqrt[3]{y}}$

(35) a) $x^8 x^2$

$= \boxed{x^{10}}$

b) $(3y^2)(4y^5)$

$= \boxed{12y^7}$

c) $x^2 x^{-6}$

$= x^{-4}$

$= \boxed{\frac{1}{x^4}}$

(36) a) $x^{-5} x^3$

$= x^{-2}$

$= \boxed{\frac{1}{x^2}}$

b) $w^{-2} w^{-4} w^6$

$= w^0$

$= \boxed{1}$

c) $z^5 z^{-3} z^{-4}$

$= z^{-2}$

$= \boxed{\frac{1}{z^2}}$

(37) a) $\frac{y^{10} y^0}{y^7} = \boxed{y^3}$

b) $\frac{x^6}{x^{10}}$

$= \boxed{\frac{1}{x^4}}$

c) $\frac{a^9 a^{-2}}{a}$

$= \boxed{a^6}$

(38) a) $\frac{z^2 z^4}{z^3 z^{-1}}$

$= \frac{z^6}{z^2}$

$= \boxed{z^4}$

b) $(2y^2)^3$

$= 2^3 y^6$

$= \boxed{8y^6}$

c) $(8x)^2$

$= 8^2 x^2$

$= \boxed{64x^2}$

1.2 cont

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(39) a) $(a^2a^4)^3$

$= (a^6)^3$

$= a^{18}$

b) $\left(\frac{a^2}{4}\right)^3$

$= \frac{a^6}{4^3}$

$= \frac{a^6}{64}$

c) $(3z)^2(6z^2)^{-3}$

$= \frac{9z^2}{(6z^2)^3}$

$= \frac{9z^2}{6^3 z^6}$

$= \frac{1}{24z^4}$

(40) a) $(2z^2)^{-5} z^{10}$

$= \frac{z^{10}}{(2z^2)^5}$

$= \frac{z^{10}}{2^5 z^{10}}$

$= \frac{1}{32}$

b) $(2a^3a^2)^4$

$= (2a^5)^4$

$= 2^4 a^{20}$

$= 16a^{20}$

c) $\left(\frac{3x^4}{4x^2}\right)^2$

$= \frac{3^2 x^8}{4^2 x^4}$

$= \frac{9x^4}{16}$

(41) a) $(4x^2y^4)(2x^5y)$

$= 8x^7y^5$

b) $(8a^2z)\left(\frac{1}{2}a^3z^4\right)$

$= 4a^5z^5$

(42) a) $b^4(3ab^3)(2a^2b^{-5})$

$= 6a^3b^2$

b) $(2s^3t^{-2})\left(\frac{1}{4}s^7t\right)(16t^4)$

$= 8s^{10}t^3$

1.2 cont

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(43) a) $(5x^2y^3)(3x^2y^5)^4$

$= (5x^2y^3)(3^4 x^8 y^{20})$

$= \boxed{405x^{10}y^{23}}$

b) $(2a^3b^2)^2(5a^2b^5)^3$

$= (2^2 a^6 b^4)5^3 a^6 b^{15}$

$= \boxed{500a^{12}b^{19}}$

(44) a) $(s^{-2}t^2)^2(s^2t)^3$

$= s^{-4}t^4 s^6 t^3$

$= \boxed{s^2 t^7}$

b) $(2u^2v^3)^3(3u^{-3}v)^2$

$= 2^3 u^6 v^9 (3^2 u^{-6} v^2)$

$= 72u^0 v^{11}$

$= \boxed{72v^{11}}$

(45) a) $\dfrac{6y^3z}{2yz^2}$

$= \boxed{\dfrac{3y^2}{z}}$

b) $\dfrac{(xy^2z^3)^4}{(x^2y^2z)^3}$

$= \dfrac{x^4y^8z^{12}}{x^6y^6z^3}$

$= \boxed{\dfrac{y^2z^9}{x^2}}$

(46) a) $\dfrac{2x^3y^4}{x^5y^3}$

$= \boxed{\dfrac{2y}{x^2}}$

b) $\dfrac{(2v^3w)^2}{v^3w^2}$

$= \dfrac{2^2v^6w^2}{v^3w^2}$

$= \boxed{4v^3}$

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(47) a) $\left(\frac{a^2}{b}\right)^5 \left(\frac{a^3 b^2}{c^3}\right)^3$

$= \left(\frac{a^{10}}{b^5}\right)\left(\frac{a^9 b^6}{c^9}\right)$

$= \boxed{\frac{a^{19} b}{c^9}}$

b) $\frac{\left(u^{-1} v^2\right)^2}{\left(u^3 v^{-2}\right)^3}$

$= \frac{u^{-2} v^4}{u^9 v^{-6}}$

$= \boxed{\frac{v^{10}}{u^{11}}}$

(48) a) $\left(\frac{x^4 z^2}{4 y^5}\right)\left(\frac{2 x^3 y^2}{z^3}\right)^2$

$= \left(\frac{x^4 z^2}{4 y^5}\right)\left(\frac{z^2 x^6 y^4}{z^6}\right)$

$= \frac{x^{10} y^4 z^2}{y^5 z^6}$

$= \boxed{\frac{x^{10}}{y z^4}}$

b) $\frac{\left(r s^2\right)^3}{\left(r^{-3} s^2\right)^2}$

$= \frac{r^3 s^6}{r^{-6} s^4}$

$= \boxed{r^9 s^2}$

(49) a) $\dfrac{8a^3b^{-4}}{2a^{-5}b^5}$

$= \boxed{\dfrac{4a^8}{b^9}}$

b) $\left(\dfrac{y}{5x^{-2}}\right)^{-3}$

$= \dfrac{y^{-3}}{5^{-3}x^6}$

$= \boxed{\dfrac{125}{x^6y^3}}$

(50) a) $\dfrac{5xy^{-2}}{x^{-1}y^{-3}}$

$= \boxed{5x^2y}$

b) $\left(\dfrac{2a^{-1}b}{a^2b^{-3}}\right)^{-3}$

$= \dfrac{2^{-3}a^3b^{-3}}{a^{-6}b^9}$

$= \boxed{\dfrac{a^9}{8b^{12}}}$

(51) a) $\left(\dfrac{3a}{b^3}\right)^{-1}$

$= \dfrac{3^{-1}a^{-1}}{b^{-3}}$

$= \boxed{\dfrac{b^3}{3a}}$

b) $\left(\dfrac{q^{-1}r^{-1}s^{-2}}{r^{-5}sq^{-8}}\right)^{-1}$

$= \dfrac{q^1r^1s^2}{r^5s^{-1}q^8}$

$= \boxed{\dfrac{s^3}{q^7r^4}}$

1.2 cont
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52 a) $\left(\frac{s^2 t^{-4}}{5 s^{-1} t}\right)^{-2}$

$= \frac{s^{-4} t^{8}}{5^{-2} s^{2} t^{-2}}$

$= \frac{(25\, t^{10})}{(s^{6})}$

b) $\left(\frac{x y^{-2} z^{-3}}{x^{2} y^{3} z^{-4}}\right)^{-3}$

$= \frac{x^{-3} y^{6} z^{9}}{x^{-6} y^{-9} z^{12}}$

$= \frac{x^{3} y^{15}}{z^{3}}$

53 $\sqrt[4]{x^4} = |x|$

54 $\sqrt[5]{x^{10}} = x^2$

56 $\sqrt[3]{x^3 y^6} = xy^2$

57 $\sqrt[6]{64 a^6 b^7}$

$= 2|a||b|\sqrt[6]{b}$

58 $\sqrt[3]{a^2 b}\ \sqrt[3]{64 a^4 b}$

$= \sqrt[3]{64 a^6 b^2}$

$= 4a^2\sqrt[3]{b^2}$

59 $\sqrt[3]{\sqrt{64 x^6}}$

$= \sqrt[3]{8|x|^3}$

$= 2|x|$

60 $\sqrt[4]{x^4 y^2 z^2}$

$= x\sqrt[4]{y^2 z^2}$

$= x\sqrt{yz}$

61 a) $x^{\frac{3}{4}} x^{\frac{5}{4}}$

$= x^{\frac{8}{4}}$

$= x^2$

b) $y^{\frac{2}{3}} y^{\frac{4}{3}}$

$= y^{\frac{6}{3}}$

$= y^2$

62 a) $(4b)^{\frac{1}{2}}(8b^{\frac{1}{4}})$

$= (2b^{\frac{1}{2}})(8b^{\frac{1}{4}})$

$= 16 b^{\frac{1}{2}+\frac{1}{4}}$

$= 16 b^{\frac{3}{4}}$

1.2 cont
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(63) a) $\dfrac{w^{\frac{4}{3}} w^{\frac{2}{3}}}{w^{\frac{1}{3}}}$

$= \boxed{w^{\frac{5}{3}}}$

b) $\dfrac{s^{\frac{5}{2}} \left(2 s^{\frac{5}{4}}\right)^2}{s^{\frac{1}{2}}}$

$= \dfrac{s^{\frac{5}{2}} \left(2^2 s^{\frac{5}{2}}\right)}{s^{\frac{1}{2}}}$

$= 4 s^{\frac{9}{2}}$

(64) a) $\left(8y^3\right)^{-\frac{2}{3}}$

$= \dfrac{1}{\left(8y^3\right)^{-\frac{2}{3}}}$

$= \dfrac{1}{8^{-\frac{2}{3}} y^{-2}}$

$= 8^{\frac{2}{3}} y^2$

$= 2^2 y^2$

$= \boxed{4y^2}$

b) $\left(u^4 v^6\right)^{-\frac{1}{3}}$

$= \dfrac{1}{\left(u^4 v^6\right)^{\frac{1}{3}}}$

$= \boxed{\dfrac{1}{u^{\frac{4}{3}} v^2}}$

(65) a) $\left(8a^6 b^{\frac{3}{2}}\right)^{\frac{2}{3}}$

$= \boxed{4a^4 b}$

b) $\left(4a^6 b^8\right)^{\frac{3}{2}}$

$\boxed{8a^9 b^{12}}$

$\left(8a^6 b^{\frac{3}{2}}\right)^{\frac{2}{3}}$

$= \left(2^3\right)^{\frac{2}{3}} \cdot \left(a^6\right)^{\frac{2}{3}} \left(b^{\frac{3}{2}}\right)^{\frac{2}{3}}$

$3\left(\frac{2}{3}\right) \quad 6\left(\frac{2}{3}\right) \quad \frac{3}{2}\left(\frac{2}{3}\right)$

$= 2 \cdot a^4 \cdot b^1$

$= 4 \cdot a^4 \cdot b$

(66) a) $(x^{-5}y^{\frac{1}{3}})^{-\frac{3}{5}}$

$= x^{-5(-\frac{3}{5})} \cdot y^{\frac{1}{3}(-\frac{3}{5})}$

$= x^{3} y^{-\frac{1}{5}}$

$= \boxed{\frac{x^3}{y^{\frac{1}{5}}}}$

b) $(2x^3y^{-\frac{1}{4}})^2 (8y^{-\frac{3}{2}})^{-\frac{1}{3}}$

$= 2^2 \cdot x^{3(2)} \cdot y^{-\frac{1}{4}(2)} \cdot 2^{3(-\frac{1}{3})} \cdot y^{-\frac{3}{2}(-\frac{1}{3})}$

$= 2^2 x^6 y^{-\frac{1}{2}} \cdot 2^{-1} y^{\frac{1}{2}}$

$= 2^{(2-1)} x^6 y^{(-\frac{1}{2}+\frac{1}{2})}$ note: $y^0 = 1$

$= \boxed{2x^6}$

(67) a) $\frac{(8s^3t^3)^{\frac{2}{3}}}{(s^4t^{-8})^{\frac{1}{4}}} = \frac{2^{3(\frac{2}{3})} \cdot s^{3(\frac{2}{3})} \cdot t^{3(\frac{2}{3})}}{s^{4(\frac{1}{4})} t^{-8(\frac{1}{4})}}$

$= \frac{2^2 s^2 t^2}{s t^{-2}}$

$= \boxed{4st^4}$

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(67) b) $\dfrac{(32y^{-5}z^{10})^{\frac{1}{5}}}{(64y^{6}z^{-12})^{-\frac{1}{6}}} = \dfrac{2^{5(\frac{1}{5})} \cdot y^{-5(\frac{1}{5})} \cdot z^{10(\frac{1}{5})}}{2^{6(-\frac{1}{6})} \cdot y^{6(-1/6)} \cdot z^{-12(\frac{-1}{6})}}$

$= \dfrac{2y^{-1}z^{2}}{2^{-1}y^{-1}z^{2}}$

$= \boxed{4}$

(68) a) $\left(\dfrac{x^{8}y^{-4}}{16y^{\frac{4}{3}}}\right)^{-\frac{1}{4}} = \dfrac{x^{8(-\frac{1}{4})} \cdot y^{-4(-\frac{1}{4})}}{2^{4(-\frac{1}{4})} \cdot y^{\frac{4}{3}(-\frac{1}{4})}}$

$= \dfrac{x^{-2} \cdot y^{1}}{2 \cdot y^{-\frac{1}{3}}}$

$= \dfrac{y^{(1+\frac{1}{3})}}{2x^{2}}$

$= \boxed{\dfrac{y^{\frac{4}{3}}}{2x^{2}}}$

note: $1 + \frac{1}{3} = \frac{3}{3} + \frac{1}{3} = \frac{4}{3}$

1.2 cont

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(68) b) $\left(\frac{-8y^{\frac{3}{4}}}{y^3 z^6}\right)^{-\frac{1}{3}} = \frac{((-2)^3)^{-\frac{1}{3}} \cdot y^{\frac{3}{4}(-\frac{1}{3})}}{y^{3(-\frac{1}{3})} \cdot z^{6(-\frac{1}{3})}}$

$= \frac{(-2)^{-1} \cdot y^{-\frac{1}{4}}}{y^{-1} \cdot z^{-2}}$

$= \frac{y^{1-\frac{1}{4}} \cdot z^2}{-2}$

$= \boxed{\frac{y^{\frac{3}{4}} \cdot z^2}{-2}}$

(69)

a) $\left(\frac{x^{-\frac{2}{3}}}{y^{\frac{1}{2}}}\right)\left(\frac{x^{-2}}{y^{-3}}\right)^{\frac{1}{6}}$

$= \left(\frac{1}{x^{\frac{2}{3}} y^{\frac{1}{2}}}\right)\left(\frac{x^{-2(\frac{1}{6})}}{y^{-3(\frac{1}{6})}}\right)$

$= \left(\frac{1}{x^{\frac{2}{3}} y^{\frac{1}{2}}}\right)\left(\frac{x^{-\frac{1}{3}}}{y^{-\frac{1}{2}}}\right)$

$= \left(\frac{1}{x^{\frac{2}{3}} y^{\frac{1}{2}}}\right)\left(\frac{y^{\frac{1}{2}}}{x^{\frac{1}{3}}}\right)$

$= \frac{y^{\frac{1}{2}}}{x^{(\frac{2}{3}+\frac{1}{3})} y^{\frac{1}{2}}}$

$= \boxed{\frac{1}{x}}$

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(69) b) $\left(\frac{4y^3z^{\frac{2}{3}}}{x^{\frac{1}{2}}}\right)^2 \left(\frac{x^{-3}y^6}{8z^4}\right)^{\frac{1}{3}}$

$= \left(\frac{4^2 \cdot y^{3(2)} \cdot z^{\frac{2}{3}(2)}}{x^{\frac{1}{2}(-)}}\right) \left(\frac{x^{-3(\frac{1}{3})} \cdot y^{6(\frac{1}{3})}}{2^{3(\frac{1}{3})} \cdot z^{4(\frac{1}{3})}}\right)$

$= \left(\frac{16y^6z^{\frac{4}{3}}}{x}\right)\left(\frac{x^{-1}y^2}{2z^{\frac{4}{3}}}\right)$

$= \frac{16y^{(6+2)} \cdot z^{\frac{4}{3}}}{2x \cdot x \, z^{\frac{4}{3}}}$

$= \boxed{\frac{8y^8}{x^2}}$

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(70) a) $\left(\frac{a^{\frac{1}{6}} b^{-3}}{x^{-1} y}\right)^3 \left(\frac{x^{-2} b^{-1}}{a^{\frac{3}{2}} y^{\frac{1}{3}}}\right)$

$= \frac{a^{3(\frac{1}{6})} \cdot b^{-3(3)}}{x^{(-1)(3)} \; y^{(1)(3)}} \cdot \frac{1}{a^{\frac{3}{2}} b^{1} x^{2} y^{\frac{1}{3}}}$

$= \frac{a^{\frac{1}{2}} b^{-9} \cdot 1}{x^{-3} \; y^{3} \cdot a^{\frac{3}{2}} b \, x^{2} \, y^{\frac{1}{3}}}$

$= \frac{1}{a^{(\frac{3}{2}-\frac{1}{2})} \; b^{(1+9)} \; x^{(-3+2)} \; y^{(3+\frac{1}{3})}}$

$= \frac{1}{a^{\frac{2}{2}} \; b^{10} \; x^{-1} \; y^{(\frac{9}{3}+\frac{1}{3})}}$

$= \boxed{\frac{x}{a \, b^{10} \, y^{\frac{10}{3}}}}$

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(70) b)

$$\frac{(9st)^{\frac{3}{2}}}{(27s^3t^{-4})^{\frac{2}{3}}}\left(\frac{3s^{-2}}{4t^{\frac{1}{3}}}\right)^{-1}$$

$$= \frac{3^{2\left(\frac{3}{2}\right)} s^{\frac{3}{2}} t^{\frac{3}{2}}}{3^{3\left(\frac{2}{3}\right)} s^{3\left(\frac{2}{3}\right)} t^{-4\left(\frac{2}{3}\right)}} \cdot \frac{3^{-1} s^{2}}{4^{-1} t^{-\frac{1}{3}}}$$

$$= \frac{3^{3} s^{\frac{3}{2}} t^{\frac{3}{2}} \cdot 3^{-1} \cdot s^{2} \cdot}{3^{2} s^{2} t^{-\frac{8}{3}} \cdot 4^{-1} t^{-\frac{1}{3}}}$$

$$= 3^{3-2} \cdot 3^{-1} \cdot 4^{1} \cdot s^{\frac{3}{2}} t^{\left(\frac{3}{2}+\frac{8}{3}+\frac{1}{3}\right)}$$

$$= 3^{1-1} \cdot 4\, s^{\frac{3}{2}} t^{\left(\frac{3}{2}+\frac{9}{3}\right)}$$

$$= 4\, s^{\frac{3}{2}} t^{3+\frac{3}{2}}$$

$$= \boxed{4\, s^{\frac{3}{2}} t^{\frac{9}{2}}}$$

note: $3 + \frac{3}{2}$

$= \frac{6}{2} + \frac{3}{2}$

$= \frac{9}{2}$

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(70) b) Again...

$$\frac{(9st)^{\frac{3}{2}}}{(27s^3t^{-4})^{\frac{2}{3}}} \div \left(\frac{3s^{-2}}{4t^{\frac{1}{3}}}\right)^{-1}$$

$$= \frac{27s^{\frac{3}{2}}t^{\frac{3}{2}}}{9s^2t^{-\frac{8}{3}}} \left(\frac{4t^{\frac{1}{3}}s^2}{3}\right)$$

$$= \boxed{4s^{\frac{3}{2}}t^{\frac{9}{2}}}$$

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(71) a) $\sqrt[6]{y^5}\sqrt[3]{y^2}$

$= y^{\frac{5}{6}} y^{\frac{2}{3}}$

$= y^{\frac{5}{6}} y^{\frac{4}{6}}$

$= y^{\frac{9}{6}}$

$= \boxed{y^{\frac{3}{2}}}$ or $\boxed{\sqrt[2]{y^3}}$

b) $\left(5\sqrt[3]{x}\right)\left(2\sqrt[4]{x}\right)$

$= 10\, x^{\frac{1}{3}} x^{\frac{1}{4}}$

$= 10\, x^{\frac{1}{3}+\frac{1}{4}}$

$= \boxed{10\, x^{\frac{7}{12}}}$

or

$\boxed{10\sqrt[12]{x^7}}$

NOTE: $\frac{1}{3}+\frac{1}{4}$

$= \frac{4}{4}\left(\frac{1}{3}\right)+\left(\frac{1}{4}\right)\left(\frac{3}{3}\right)$

$= \frac{4}{12}+\frac{3}{12}$

$= \frac{7}{12}$

(72) a) $\sqrt[4]{b^3}\sqrt{b}$

$= b^{\frac{3}{4}} \cdot b^{\frac{1}{2}}$

$= b^{\frac{3}{4}+\frac{1}{2}\left(\frac{2}{2}\right)}$

$= b$

$= \boxed{b^{\frac{5}{4}}}$

or

$\boxed{\sqrt[4]{b^5}}$

b) $2\sqrt{a}\sqrt[3]{a^2}$

$= 2\, a^{\frac{1}{2}} a^{\frac{2}{3}}$

$= 2\, a^{\frac{3}{3}\left(\frac{1}{2}\right)+\frac{2}{3}\left(\frac{2}{2}\right)}$

$= \boxed{2\, a^{\frac{7}{6}}}$

or

$\boxed{2\sqrt[6]{a^7}}$

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(73) a) $\sqrt{4st^3}\sqrt[6]{s^3t^2}$

$(4st^3)^{\frac{1}{2}}(s^3t^2)^{\frac{1}{6}}$

$= 2s^{\frac{1}{2}}t^{\frac{3}{2}}s^{\frac{1}{2}}t^{\frac{1}{3}}$

$= 2st^{\frac{11}{6}}$

(73) b) $\dfrac{\sqrt[4]{x^7}}{\sqrt[4]{x^3}} = \sqrt[4]{\dfrac{x^7}{x^3}}$

$= \sqrt[4]{x^4}$

$= \boxed{x}$

(74) a) $\sqrt[5]{x^3y^2}\sqrt[10]{x^4y^{16}}$

$= (x^3y^2)^{\frac{1}{5}}(x^4y^{16})^{\frac{1}{10}}$

$= (x^3y^2)^{\frac{2}{10}}(x^4y^{16})^{\frac{1}{10}}$

$= x^{\frac{6}{10}}y^{\frac{4}{10}}x^{\frac{4}{10}}y^{\frac{16}{10}}$

$= x^{\frac{10}{10}}y^{\frac{20}{10}}$

$= \boxed{xy^2}$

b) $\dfrac{\sqrt[3]{8x^2}}{\sqrt{x}} = \dfrac{(8x^2)^{\frac{1}{3}}}{x^{\frac{1}{2}}}$

$= 2x^{\frac{2}{3}}x^{-\frac{1}{2}}$

$= 2x^{\frac{2}{3}(\frac{2}{3})-\frac{1}{2}(\frac{2}{3})}$

$= 2x^{\frac{4}{6}-\frac{3}{6}}$

$= 2x^{\frac{1}{6}}$

$= \boxed{2x^{\frac{1}{6}}}$

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75 a) $\sqrt[3]{y\sqrt{y}}$

$= \sqrt[3]{y y^{\frac{1}{2}}}$

$= \left(y y^{\frac{1}{2}}\right)^{\frac{1}{3}}$

$= y^{\frac{1}{3}} y^{\frac{1}{6}}$

$= y^{\frac{3}{6}}$

$= \boxed{y^{\frac{1}{2}} \text{ or } \sqrt{y}}$

b) $\sqrt{\frac{16u^3v}{uv^5}} = \sqrt{\frac{16u^2}{v^4}}$

$= \left(\frac{16u^2}{v^4}\right)^{\frac{1}{2}}$

$= \boxed{\frac{4u}{v^2}}$

76 a) $\sqrt{5\sqrt{5^3}}$

$= \sqrt{5 \cdot 5^{\frac{3}{2}}}$

$= \left(5 \cdot 5^{\frac{3}{2}}\right)^{\frac{1}{2}}$

$= 5^{\frac{1}{2}} 5^{\frac{3}{4}}$

$= 5^{\frac{2}{4}} 5^{\frac{3}{4}}$

$= 5^{\frac{5}{4}}$

$= \boxed{5^{\frac{5}{4}} \text{ or } \sqrt[4]{5^5}}$

b) $\sqrt[3]{\frac{54x^2y}{2x^5y}}$

$= \sqrt[3]{\frac{27}{x^3}}$

$= \frac{\sqrt[3]{27}}{\sqrt[3]{x^3}}$

$= \boxed{\frac{3}{x}}$

(77) a) $69,300,000 = 6.93 \times 10^{7}$

b) $7,200,000,000,000 = 7.2 \times 10^{12}$

c) $0.0000285 36 = 2.8536 \times 10^{-5}$

d) $0.000 1213 = 1.213 \times 10^{-4}$

(78) a) $129,540,000 = 1.2954 \times 10^{8}$

b) $7,259,000,000 = 7.259 \times 10^{9}$

c) $0.000 000 0014 = 1.4 \times 10^{-9}$

d) $0.0007029 = 7.029 \times 10^{-4}$

(79) a) $3.19 \times 10^{5} = 319,000$

b) $2.721 \times 10^{8} = 272100000$

c) $2.670 \times 10^{-6} = 0.000000 02670$

d) $9.999 \times 10^{-9} = 0.000000009999$

(80) a) $7.1 \times 10^{14} = 710,000,000,000,000$

b) $6 \times 10^{12} = 6,000,000,000,000$

c) $8.55 \times 10^{-3} = 0.00855$

d) $6.257 \times 10^{-10} = 0.000000 000 6257$

1.21 out
p 22

(81) a) 5,900,000,000,000 mi = 5.9×10^{12} mi

b) 0.000 000 000 000 4 cm = 4×10^{-13} cm

~~c) 5,970,000,000,000,000,000,000,000 kg = 5.97×10^{24} kg~~

c) 33 billion billion molecules =
$33 \times 10^9 \times 10^9 = 33 \times 10^{18} = 3.3 \times 10^{19}$ molecules

(82) a) 93 million miles = 93,000,000 = 9.3×10^6 mi

b) 0.000 000 000 000 000 000 000 005 3 g
= 5.3×10^{-23} g

c) 5,970,000,000,000,000,000,000,000 kg
= 5.97×10^{24} kg

(83) $(7.2 \times 10^{-9})(1.806 \times 10^{-12})$

$= 1.30032 \times 10^{-20}$

$\doteq 1.3 \times 10^{-20}$

(84) $(1.062 \times 10^{24})(8.61 \times 10^{19})$

$= 914382$

$= 9.14382 \times 10^5$

$\doteq 9.14 \times 10^5$

1.2 cont

p 23

(85) $$\frac{1.295643 \times 10^{9}}{(3.610 \times 10^{-17})(2.511 \times 10^{6})}$$

$$= \frac{1.295643 \times 10^{9}}{(3.610)(2.511) \times 10^{-11}}$$

$$= \frac{1.295643 \times 10^{20}}{(3.610)(2.511)}$$

$$= \frac{1.295643 \times 10^{20}}{9.06471}$$

$$= 1.429326476 \times 10^{19}$$

$$\approx \boxed{1.429 \times 10^{19}}$$

(86) $$\frac{(73.1)(1.6741 \times 10^{28})}{0.000\,000\,001\,9} = \frac{1.1945271 \times 10^{30}}{0.000\,000\,001\,9}$$

$$= 6.286984737 \times 10^{38}$$

$$\approx \boxed{6.3 \times 10^{38}}$$

(87) $$\frac{(0.000\,0162)(0.01582)}{(594,621,000)(0.0058)} = \frac{2.56284 \times 10^{-7}}{3,448,801.8}$$

$$= 7.431102579 \times 10^{-14}$$

$$\doteq \boxed{7.4 \times 10^{-14}}$$

p.23

(88) $\dfrac{(3.542 \times 10^{-6})^9}{(5.05 \times 10^{4})^{12}} = \dfrac{3.542^9 \times 10^{-54}}{5.05^{12} \times 10^{48}}$

$= \dfrac{3.542^9 \times 10^{-102}}{5.05^{12}}$

$= \dfrac{3.542^9}{5.05^{12}} \times 10^{-102}$

$= 3.189631225 \times 10^{-4} \times 10^{-102}$

$\doteq \boxed{3.19 \times 10^{-106}}$

(89) a) $\dfrac{1}{\sqrt{10}}\left(\dfrac{\sqrt{10}}{\sqrt{10}}\right)$

$= \boxed{\dfrac{\sqrt{10}}{10}}$

b) $\sqrt{\dfrac{2}{x}}$

$= \dfrac{\sqrt{2}}{\sqrt{x}}\left(\dfrac{\sqrt{x}}{\sqrt{x}}\right)$

$= \boxed{\dfrac{\sqrt{2x}}{x}}$

c) $\sqrt{\dfrac{x}{3}}$

$= \dfrac{\sqrt{x}}{\sqrt{3}}\left(\dfrac{\sqrt{3}}{\sqrt{3}}\right)$

$= \boxed{\dfrac{\sqrt{3x}}{3}}$

(90) a) $\sqrt{\dfrac{5}{12}}$

$= \dfrac{\sqrt{5}}{\sqrt{12}}\left(\dfrac{\sqrt{12}}{\sqrt{12}}\right)$

$= \boxed{\dfrac{\sqrt{60}}{12}}$

b) $\sqrt{\dfrac{x}{6}}$

$= \dfrac{\sqrt{x}}{\sqrt{6}}\left(\dfrac{\sqrt{6}}{\sqrt{6}}\right)$

$= \boxed{\dfrac{\sqrt{6x}}{6}}$

c) $\sqrt{\dfrac{y}{22}}$

$= \dfrac{\sqrt{y}}{\sqrt{22}}\left(\dfrac{\sqrt{22}}{\sqrt{22}}\right)$

$= \boxed{\dfrac{\sqrt{22yz}}{22}}$

(91) a) $\dfrac{2}{\sqrt[3]{x}}\left(\dfrac{\sqrt[3]{x^2}}{\sqrt[3]{x^2}}\right)$

$= \dfrac{2\sqrt[3]{x^2}}{x}$

b) $\dfrac{1}{\sqrt[4]{y^3}}\left(\dfrac{\sqrt[4]{y}}{\sqrt[4]{y}}\right)$

$= \boxed{\dfrac{\sqrt[4]{y}}{y}}$

c) $\dfrac{x}{y^{\frac{2}{5}}}\left(\dfrac{y^{\frac{3}{5}}}{y^{\frac{3}{5}}}\right)$

$= \boxed{\dfrac{x y^{\frac{3}{5}}}{y} \text{ or } \dfrac{x\sqrt[5]{y^3}}{y}}$

1.2 cont

p 23 (92) a) $\frac{1}{\sqrt[4]{a}}\left(\frac{\sqrt[4]{a^3}}{\sqrt[4]{a^3}}\right)$ b) $\frac{a}{\sqrt[3]{b^2}}\left(\frac{\sqrt[3]{b}}{\sqrt[3]{b}}\right)$ c) $\frac{1}{c^{\frac{3}{7}}}\left(\frac{c^{\frac{4}{7}}}{c^{\frac{4}{7}}}\right)$

$= \boxed{\frac{\sqrt[4]{a^3}}{a}}$ $= \boxed{\frac{a\sqrt[3]{b}}{b}}$ $= \boxed{\frac{c^{\frac{4}{7}}}{c} \text{ or } \frac{\sqrt[7]{c^4}}{c}}$

(93) $a, b, + c \in \mathbb{R}$ $a > 0$, $b < 0$, $+ c < 0$

a) $\boxed{b^5 < 0}$ $(neg)^5 = neg$

b) $\boxed{b^{10} > 0}$ $(neg)^{10} = pos$

c) ab^2c^3 $a > 0$ $b^2 > 0$ $c^3 < 0$ $\therefore$ $\boxed{ab^2c^3 < 0}$ $pos\ (pos)^2 (neg)^3 = neg$

d) $(b-a)^3$ $b - a < 0$ $\therefore$ $\boxed{(b-a)^3 < 0}$ $(neg)^3 = neg$

e) $(b-a)^4$ $(b-a) < 0$ $\therefore$ $\boxed{(b-a)^4 > 0}$ $(neg)^4 = neg$

f) $\frac{a^3c^3}{b^6c^6}$ $a^3 > 0$ $c^3 < 0$ $b^6 > 0$ $c^6 > 0$ $\frac{(pos)(neg)}{(pos)(pos)} = \frac{neg}{pos} = neg$

$\boxed{\frac{a^3c^3}{b^6c^6} < 0}$

1,2 cont

P 23

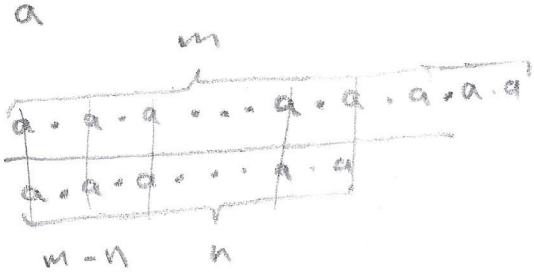
(94)

a) Law 2

$m > 0, n > 0, m > n$

$a \in \mathbb{R} \neq 0$

$$\frac{a^m}{a^n} = a^{m-n}$$

$a^m =$ 

$= \overbrace{a \cdot a \cdot a}$

$= a^{m-n}$